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throat (*Cyanecula suecica*) may make the journey from Northern Africa to the Scandinavian Peninsula—a distance of 2,000 to 2,400 geographical miles—during a single May night, giving a velocity of four miles a minute, or 240 miles an hour! The American Golden Plover, he affirms, migrates in autumn from Labrador to Brazil—a distance of 3,000 miles—in a single uninterrupted flight, going at an average rate of ‘212 geographical miles per hour.’ As he offers nothing but negative evidence and conjecture in proof of these statements, they are scarcely entitled to serious notice, so contrary are they to all of the known evidence bearing on the case. In Chapter VI., on the ‘Order of Migration According to Age and Sex,’ the evidence in support of his theory that “the autumn migration is initiated by the young birds, from about six to eight weeks after leaving the nest,” does not well bear close analysis. But the worst portion of his book is the fourteen pages relating to ‘Changes in the Colour of the Plumage of Birds without Moulting,’ in which he asserts that the breeding dress in many birds is acquired by a change in the color of the feathers themselves without any alteration or change in their texture, whereby pure white feathers change to dark brown or black; and not only this, but the worn jagged edges of the old feathers at the same time are restored to their former size and evenly rounded outline, so as to look in reality like new feathers. As a matter of fact, the very species he cites and describes in detail as undergoing this wonderful process are well known to acquire their breeding dress by a spring molt! In view of these and other misstatements the review closes with the following: “With all its imperfections ‘Heligoland’ is a book of great interest and value, Part III. being a particularly useful contribution to the literature of ornithology. It is also a work that is likely to do much harm, for it is its sensational and inaccurate parts especially that find their way into the current literature of the day, and particularly into magazines and books devoted to the popularization of natural history.”

The department of ‘Recent Literature’ contains the usual complement of reviews of leading works and papers on ornithology, and the

department of ‘General Notes’ some thirty brief notices of rare or little known species, relating mainly to their occurrence at unusual or entirely new localities. Under the heading ‘Correspondence’ some ten pages are devoted to the discussion of various questions of nomenclature, by Witmer Stone, H. C. Oberholser and the editor, the number concluding as usual with several pages of ‘Notes and News.’

#### SOCIETIES AND ACADEMIES.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON,  
MARCH 28.

MR. CHARLES RICHARD DODGE read a paper on some undeveloped American fibers. He stated that government experiments for the development of fiber industries in different countries date back nearly one hundred years. A necessity for such government aid is the importance of securing disinterested experts to prosecute the work, that the investigations and experiments may be conducted in a scientific manner. Such experiments relate to the testing of the strength of fibrous substances, the testing of new machines or new chemical processes for their preparation, and the cultivation of fiber plants when necessary to demonstrate their precise economic value.

In the United States 15 commercial fibers are recognized, only four of which are produced to any extent within our borders: cotton, hemp, palmetto and Spanish moss. The commercial forms not grown, but which might be produced in this country, are flax, jute, sisal hemp, New Zealand flax, cocoanut and possibly sunn hemp.

There are many other forms of plants, some of them classed as American weeds, which produce fibers known as jute or hemp substitutes, that it will not pay to cultivate while the standard fibers hold the market. These are chiefly bast fiber plants.

The flax industry is being reestablished in this country, on the lines of an ‘American practice’ laid down by the Department of Agriculture, and gratifying progress has already been made in the new industry. Sisal hemp and some alleged forms of structural fiber plants will thrive in southern Florida. Ramie culture and the spinning and manufacture of the fiber are

no longer problems, though the world waits for a successful machine to clean the fiber for market.

There are many hundreds of fiber plants in the world, and the fiber expert is constantly asked to give information concerning the more promising species, not always with a view to cultivation, but often that useless expense in experimentation may be avoided through proper knowledge of their value. The question to be asked in considering a new form of fiber is not "Can we grow the species?" but "What commercial fiber will it compete with, or become a substitute for?" With a definite knowledge of the subject, as it relates to the fibers of the world, the expert need never be in doubt regarding the economic value of any species that may be submitted to him for an opinion.

The commercial fibers represent, in a sense, the survival of the fittest, and until these are crowded out by new conditions there is little chance for the other fibers, unless a particular species is found adapted to some new and special use for which the standard forms are not available.

The second paper was on *Geographic Names* by Henry Gannett.

BERNARD R. GREEN,  
*Secretary.*

APRIL 11, 1896.

MR. S. P. LANGLEY read a paper on 'More recent observations in the infra-red spectrum.'

He referred to a communication to the Society more than two years ago, in which the expectation was held out of an early publication of a map of the infra-red spectrum made by the bolometer, and he desired to explain some of the difficulties which had caused its delay.

It was the misfortune of the astro-physical observatory here that appropriations for its maintenance were made in such a form that a proper building could not be erected in some site free from tremor, and under circumstances providing against local disturbance. As had already been stated in official reports, such local causes had introduced numerous errors in the record, in the form of tremors and oscillations in the photographic trace of the movements of the needle controlled by the bolometer, which

it was almost impossible to exclude in the present installation. The linear spectra which had been shown here and before the British Association were all produced by a nearly automatic process, the minutest line in the spectrum implying a corresponding minuteness in the original curve; and in this connection he desired to call attention to the statement in a previous report, to the effect that all the minuter details, such as had been shown here and at Oxford, had not been verified; and to the fact that illustrations of the minuter detail in linear form were given at that time, with the caution that they were presented 'only in illustration,' and were 'not to be treated as a criterion of the final results.'

The amount of local error is roughly proportional to the minuteness of the detail sought. Thus, in the spectrum shown here, and later at Oxford, giving the leading lines discovered by the new method, nearly everything has stood the test of subsequent investigation; while of the minuter detail in the curves of which a linear translation was then given, in illustration of the process, a large proportion had been subsequently found to lie under suspicion.

The extent to which the character of the work had been influenced by these local conditions having been more and more recognized, the labor of the past two years had consisted largely in weeding out errors arising from them, and the process had involved the slow reconstruction or modification of nearly every portion of the apparatus, with special reference to the difficulties imposed by the site and the insufficient installation.

Details of the new apparatus were then given with lantern illustrations, particular attention being directed to the introduction of the system of suspending the galvanometer so that ground tremors were not conveyed to it, or were conveyed in diminished intensity, a change which was stated had been a most essential improvement, and which had done away, not entirely, but more than might have been thought possible, with the inconveniences of a site surrounded by city traffic.

Many bolographs had been taken during the past year, but only within the past months had the apparatus been brought to such a condition

that the local causes of error were diminished to a degree consistent with the desired standard of accuracy. In illustration of the difficulties overcome, it was stated that while a current passing through the bolometer is something like  $\frac{1}{10}$  ampere, and while a current of less than  $\frac{1}{1000}$  millionth part of this will cause a deflection of a millimeter on the scale, no such deflection was visible in the automatic trace shown in illustration. The bolometer was nearly as sensitive at the time of the last communication as it has been made since, and the work of the past two years has lain in guarding this sensitiveness against local causes of error, so that it shall be engaged in legitimate service, and respond only to a message from the sun. The speaker trusted that the final results of this labor would soon be made public, and concluded by renewing a statement of his obligation to those gentlemen who had been previously connected with the work, and by an expression of his indebtedness to Messrs. Abbot, Child and Fowle, who are associated with its present development.

MR. E. D. PRESTON read a paper on French, German and English systems of shorthand writing, in which he gave a brief review of shorthand writing from the time of the ancient systems down to the present day. The principles underlying the art were illustrated by examples from the French (Duployé) German (Gabelsberger) and English (Pitman). A comparison was made with reference to accuracy and rapidity in the three cases. Special contractions depending on the particular language employed were also illustrated. As a further test in order that no advantage should be given to either, each of the systems was applied to a strictly phonographic tongue (Polynesian) outside of the Indo-European family of languages. The conclusion was that English shorthand is the most philosophical, the French the simplest, and the German the most vigorous.

MR. R. A. HARRIS, of the U. S. Coast and Geodetic Survey, read a paper the objects of which were "To show in a non-mathematical way what simple oscillations go to make up the complex tidal wave; to give a short account of the harmonic treatment of tides, and to describe briefly certain mechanical aids which are, or

may be, used in connection with the analysis and prediction of tides."

The principal tidal components were pointed out by considering what their 'speeds' must be in order to cause them to gain or lose one oscillation on a component having a 'speed' equal to the apparent diurnal motion of the moon or sun, or twice this motion, after the lapse of certain times, as a tropical month or year, an anomalistic month or year, a half tropical month or year, a half synodical month, etc.

A sample was shown of the perforated sheets devised by Mr. L. P. Shidy, of the Survey, and styled 'stencils,' which have been in constant use for upwards of ten years. They indicate how the hourly heights are to be combined in the various kinds of summation, and so do away with the necessity of copying and recopying the tabular values.

A design of an adding apparatus to be governed by a stencil sheet embracing, side by side, all components to be summed for was shown. This, if constructed, would enable a person to sum simultaneously for all components almost as rapidly as for a single one upon an ordinary adding machine. The stencil sheet does away with the necessity of the great variety of gears (representing 'speeds') found in the Thomson harmonic analyzer, and insures positive workings. In fact, there are but two kinds of gear wheels in the adding apparatus, one containing, say, 300 teeth each, and the other, serving as counters, containing 299. The number of wheels in each of these two sets is 24 times the number of components to be summed for. Each 54 partial sums thus obtained are then to be analyzed in the usual way.

Brief mention was made of the predicting machines already constructed, and comparisons were made with the one now being built by the Survey.

BERNARD R. GREEN,  
*Secretary.*

#### GEOLOGICAL SOCIETY OF WASHINGTON.

THE meeting of this Society of April 8th was devoted to a general discussion of the subject of the application of stratigraphy and paleontology in determining subdivisions of geologic time.

The broad problems involved in the announced topic were primarily presented by Mr. Whitman Cross in a concrete case. He described the present state of knowledge regarding the formations of the Rocky Mountain region belonging to the periods between the Marine Cretaceous and the Wasatch Eocene, including the Laramie, Arapahoe, Denver, Ft. Union and Puerco. The stratigraphic relations as at present known were described, and then the facts of the fossil floras, the invertebrate and the vertebrate faunas, were summarized. From the facts given it appears that the geologist investigating the formations of the group named is confronted by much conflict of evidence as to the relative importance of the time intervals separating the epochs of sedimentation. This is especially true in respect to the drawing of a line between the Mesozoic and Cenozoic in this region. The conflict of evidence in this instance was cited to show the necessity for a careful examination as to the nature of the connection between great faunal changes and the contemporaneous events of stratigraphic history. It appears that all forms of life were able to survive the period of great orographic disturbance at the close of the Laramie proper without radical change and that the dominant vertebrate life of the Post-Laramie disappeared at the close of that epoch from causes as yet unknown, which did not affect in any corresponding degree the contemporaneous plant and invertebrate life.

Mr. F. H. Knowlton presented a review of the fossil floras of the Laramie, Arapahoe, Denver and Fort Union formations, showing the strong distinctive characters of each and also their intimate relationship. This evidence fails to indicate any one break of supreme importance in this series of epochs.

Mr. T. W. Stanton reviewed in a similar manner the known invertebrate life of the upper Cretaceous and lower Eocene deposits of the Rocky Mountain region. The termination of true marine conditions was deemed to be the only safe criterion from this evidence to be applied in drawing a boundary for Mesozoic time.

A comparison of the vertebrate faunas of the Post-Laramie, Puerco and Wasatch formations,

by Prof. W. B. Scott, of Princeton, was read by Mr. Cross. This brought out the remarkable differences in the vertebrate life of the three epochs, and also the impossibility of explaining the abrupt changes in these faunas from our present knowledge of attendant conditions.

Mr. F. V. Coville gave a review of the conditions affecting the distribution and changes in *living* floras, starting with the great controlling factors, heat and moisture, and making suggestions as to the applicability of these data to geological history.

Dr. C. Hart Merriam similarly described the conditions most affecting the distribution or causing modifications of terrestrial vertebrate life of the present, and discussed the apparent application of these facts to the past.

Mr. Bailey Willis referred to the variable relations which might exist between angular unconformity and otherwise important stratigraphic breaks.

Mr. R. T. Hill briefly referred to the development of knowledge of the Lower Cretaceous series of Texas, to which he had given twenty years' study, and brought out facts that bore in a general way on the subject under discussion.

W. F. MORSELL.

#### THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 248th regular meeting of the Society was held April 7, 1896.

Dr. Arthur MacDonald read a paper entitled *Psycho-Neural Measurements of Human Beings with Illustrations and Experiments*.

*Introduction:* Philosophy in the old sense is almost impossible; no one man can have sufficient insight into the different sciences to understand their relations and make judgment of their content. Specialism may narrow a man, but it deepens his knowledge. Knowledge is so dovetailed together that a specialty studied thoroughly necessitates the investigation of the nearest lying branches. Generalism is liable to be superficial. The habit of studying one thing thoroughly is the method of specialism and is directly practical. The desire to include the universe may be called *generalism*.

Facts about the nervous system of man are

as important as facts about stones, plants and animals; yet there is, perhaps, the least definite knowledge about man. The scientific study of man in an experimental way is in its beginning. A man should *investigate* fifty times as much as he *writes*, and not *vice versa*.

*Breathing*.—Experiments with Ludwig's kymographion, the pneumograph and the Cambridge tambour, as made by Dr. MacDonald on four school children and three adults, seemed to indicate that concentration of mind or emotion lessens breathing. The effect between pathetic and lively music is noticeable.

*Circulation*.—In a somewhat extended experiment on a reporter with his newly constructed plethysmograph Dr. MacDonald found that: (1) By applying the algometer to the temporal muscle there was a decrease of flow of blood in the arm. (2) By passing a galvanic current through the brain, causing a pain like the prick of a pin, the effect was a decrease of flow of blood in the arm.

*Fatigue*.—By experiments on two women and two men with Mosso's Ergograph the results of Lombard were confirmed, to wit, that the recovery of the power of the finger after fatigue owes its periodicity to fatigue.

Dr. MacDonald illustrated with instruments of his own and those of others quantitative measurements of sensibilities of smell, heat, locality, pain and muscular judgments.

The second paper was by Dr. Thos. Wilson on 'Marriage in Nature and in Law.'

J. H. McCORMICK,  
General Secretary.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, APRIL 7, 1896.

THE Mineralogical and Geological Section having precedence, M. Jos. Willcox described the process of obtaining quartz from the Oriskany sandstone of Pennsylvania to be used in the manufacture of glass. Mr. Keeley stated that the bed used for the purpose extends southward through Bedford county, where the material can be used without crushing, as it crumbles when exposed to the air.

Prof. Carter suggested the use of stone from the Conshohocken quarries as a source of silica. When dissolved in hydrochloric acid the stone

yields flattened, transparent grains of silica, not at all colored by iron. The percentage of mica is small, the glistening appearance of the rock being due to the presence of silica.

Mr. Geo. Vaux, Jr., called attention to recent additions to the William S. Vaux collection, which included superb crystals of calcite from the Joplin region, Missouri. They occur in caves opened for the working of lead and zinc. The several mines are characterized by distinct forms of the mineral. The sphalerite which is largely present is being desited at the present time, the handles of shovels and picks left in the mines being covered with crystals. Unfortunately these had all been thrown into the reducing furnace and destroyed.

Mr. Theodore D. Rand described a fine collection of polished serpentines presented by him to the Academy from numerous localities in southeastern Pennsylvania. They belong to two groups: one bordering the ancient gneiss, the other, and the more recent, occurring in the mica-schists and gneisses. The former are altered igneous rocks, either chrysotitic or pyroxenic, the chief material being enstatite. The sources of the several forms were traced.

Dr. Florence Bascom reported the microscopic examination of thin sections of serpentine from the Black Rocks of Lower Merion. The mineral from this locality has been derived from chrysolite. That from the Conshohocken dyke is composed of diabase having the feldspar crystals in the lath-like form characteristic of that rock.

It was announced that Mr. G. Frederic Russell, accompanied by Dr. Querch and a taxidermist, had started from Georgetown, British Guiana, March 11th, on a collecting tour in the interior for the benefit of the Academy.

EDWARD J. NOLAN,  
Recording Secretary.

NEW YORK ACADEMY OF SCIENCES, SECTION OF ASTRONOMY AND PHYSICS.

At the regular meeting, held on April 6, 1896, the following program was presented before the section, Prof. J. K. Rees presiding:

The first paper was by Mr. P. H. Dudley, on the following title: 'The Law of Deflection of Sets Under Drop Tests in Different Sections of

Steel Rails of Uniform Physical Properties Follows the Comparative Moments of Inertia of the Respective Sections.' Mr. Dudley described the improvements in the manufacture of steel rails which has been carried out under his direction during the last five years. The object was to produce a much stiffer rail than that which had been previously employed, and at the same time to make one out of a higher grade of steel. The rails have now been in use several years on the Boston & Albany and New York Central railroads, and they show a marked improvement over the old patterns in that the deflections have been decidedly lessened. Careful records of them have been kept by means of Mr. Dudley's track inspection machine. A great deal of information has also been accumulated by Mr. Dudley in connection with the tests of samples from each heat of steel in the process of manufacture. The full paper will be subsequently published by the Academy.

In the absence of Prof. Jacoby the contents of his paper on 'The Permanence of the Rutherford Photographs' were briefly summarized by Prof. Rees. Recent and very careful measurements made upon Rutherford negatives, which had been developed twenty or thirty years ago and which had been measured five to ten years ago, show absolutely no change in the plates, so far as could be detected. The film remains in the same part of the glass as when first studied. The negatives were made upon wet plates, and the speaker remarked that it remains to be shown whether the newer dry plates afford the same permanence.

The next paper was by Prof. J. K. Rees, on: (1) 'The Harvard College Observatory photographs of star clusters, planets, variable stars and stellar spectra.' (2) 'Prof. J. E. Keeler's photographs of planetary spectra.' Prof. Rees exhibited a large series of photographs of various astronomical subjects, which had been loaned by Prof. Pickering, of the Harvard Observatory, for the recent exhibition of the New York Academy of Sciences. He also threw upon the screen, by means of the lantern, a series of photographs of star clusters which included variable stars, and which show these variables at different periods. The originals were taken at the Harvard Observatory.

In the second part of his paper Prof. Rees threw upon the screen enlargements from photographs of stellar spectra which had been taken by Prof. Keeler, of the Observatory at Allegheny, Pa. The photographs of the spectra of Saturn were also shown, which prove that the ring about the planet is due to a stream of meteorites.

The last paper of the evening was the following by Prof. M. I. Pupin: 'Communication of some new Results of Experiments with the Röntgen rays.' This paper was printed in full in SCIENCE. April 10. Experimental demonstration of the points advanced was subsequently made for the members of the Academy in Prof. Pupin's laboratory.

J. F. KEMP,  
*Secretary.*

#### NORTHWESTERN UNIVERSITY SCIENCE CLUB.

At the meeting of March 6th, Dr. Marcy in the chair, papers were presented by the Department of Mathematics.

Prof. Holgate gave the 'Problem of the Eight Queens,' which is so to place eight queens on a chessboard that no one will be endangered by any other, or, in general, to place  $n$  pieces on a square board so that no two will be in the same row, same column, or same diagonal. This problem was first proposed by Nauck to Gauss, was the subject of correspondence between Gauss and Schumacher and was finally solved by Gauss in 1850. In 1874 Günther suggested a solution of which Glaisher made use in a solution which he published that year in the *Philosophical Magazine*. Dr. Holgate presented Glaisher's solution in full.

Prof. White presented Poncelet's problem concerning polygons that possess both an inscribed and circumscribed conic. The parametric representations of the points of a conic, the doubly quadric relations of pairs of points, and the statement of periodic relations of this kind by the aid of elliptic functions, were treated in the manner of Euler, Jacobi and Hurwitz.

A. R. CROOK,  
*Secretary.*

EVANSTON, ILL.

*Erratum:*—On page 604, paragraph 2, line 2, for *Instinct* read *Insect*.